*Double Speed Progressive Scan CCD Camera*

# *CV-M40*

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# *Operation Manual*

*(Rev.C)*

CE

# DECLARATION OF CONFORMITY

AS DEFINED BY THE COUNCIL DIRECTIVE

89/336/EEC
EMC (ELECTROMAGNETIC COMPATIBILITY)

WE HEREWITH DECLARE THAT THIS PRODUCT

COMPLIES WITH THE FOLLOWING PROVISIONS APPLYING TO IT.

EN-50081-1

EN-50082-1

# Table of Contents

# 1. General

The CV-M40 is a 1/2" CCD progressive scan camera, incorporating double speed and partial scan techniques, housed in a compact and robust package.
Using the latest CCD sensor technology with square pixels provides excellent resolution and signal to noise ratio, together with flexible asynchronous random trigger functions and multitude of user settings.

# 2. Main Features

- 1/2" IT monochrome CCD sensor
- 654 (h) x 494 (v) x 9.9 μm square pixels (compatible with VGA format)
- 60 full progressive frames per second over a single video output
- 120 frames per second using vertical binning (half vertical resolution, pixel aspect ratio 1:2)
- Internal, external, HD/VD or random synchronization
- 3 external trigger/readout modes : Edge pre-select, pulse width and frame-delay readout
- Shutter speed 1/125 to 1/12,000
- 24.5 MHz pixel frequency and 31.468 kHz line frequency
- Video output with or without sync.
- Set-up by RS 232C or switches
- Up to 233 frames per second with partial scan (user selectable)

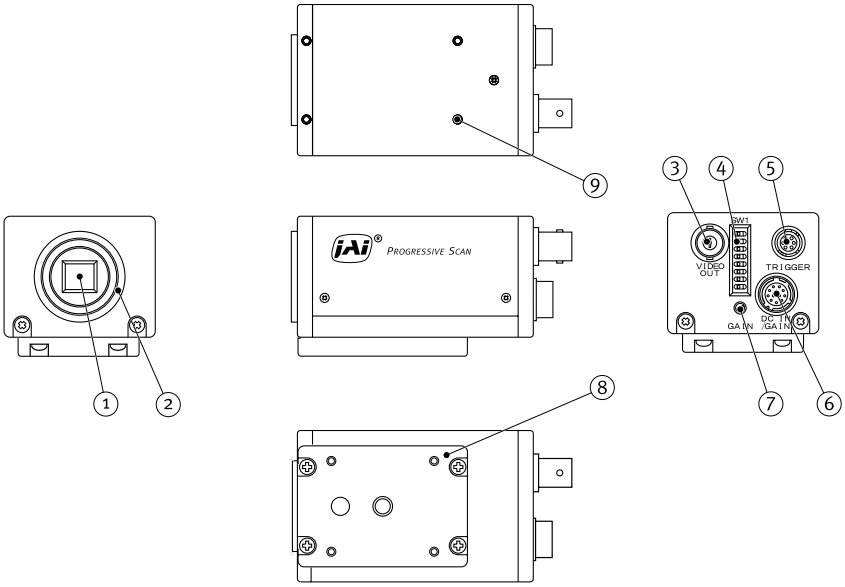
# 3. Standard composition

| | | |
|---|---|---|
| 1) | Camera main body | x 1 |
| 2) | Tripod mount plate (MP-40) | x 1 |
| 3) | Operation manual | x 1 |

## Optional accessories

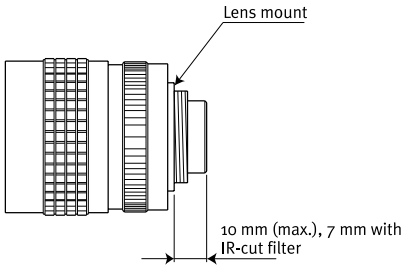
1) 12 pin connector (HR10A-10P-12S-01)
2) 6 pin connector (HR10A-7P-6S)

# 4. Locations and functions




1. CCD sensor : 1/2 " IT CCD sensor
2. Lens mount : C-mount type

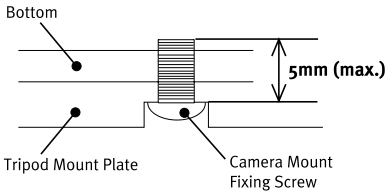
Note :
Rear protrusion on C-mount lens must be less than 10 mm (0.4 inch approx).
When IR-cut filter is used, it must be less than 7.0 mm (0.28 inch approx).




3. BNC connector : Video output (VS 1.0 Vpp at 75 Ohm)
4. SW1 switch : Shutter speed and function modes selection
5. 6 pin multi connector : RS 232 input and output / ext. trig input
6. 12 pin multi connector : +12V DC power / video output / sync. input and output
7. Gain potentiometer : Gain level adjustment
8. Tripod mount plate
9. Screw holes for Tripod mount plate

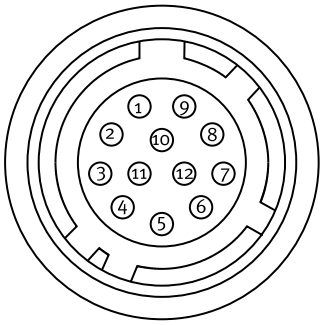
**CAUTION**

When you mount the camera on your system, please make sure to use screws which have the length less than 5 mm from the camera bottom plate, as it may cause a serious damage to the PCB inside the camera when the length is more than 5 mm.
Please be advised that the supplied 4 screws for Tripod mount plate are to be used exclusively for MP-40, but not for any other mounting adaptor.



# 5. Pin assignment

## 5-1. 12 pin connector (DC IN/SYNC connector)




HR10A-10R-12PB-01 (Hirose) male

| Pin No. | Ext Sync Mode (Factory setting) | Ext Trigger Mode H-Reset | Ext Trigger Mode H Non-reset | Int Sync Mode |
|---|---|---|---|---|
| 1 | GND | | | |
| 2 | DC+12V IN | | | |
| 3 | GND(VIDEO) | | | |
| 4 | VIDEO OUT | | | |
| 5 | GND | | | |
| 6* | Ext.HD IN | Ext.TRIG IN | Ext.HD IN | Int.HD OUT |
| 7* | Ext.VD IN | WEN OUT | Ext.TRIG IN | Int.VD OUT |
| 8 | GND | | | |
| 9* | NC | PLCK/WEN OUT | PLCK/WEN OUT | NC |
| 10 | GND | | | |
| 11 | DC+12C IN | | | |
| 12 | GND | | | |

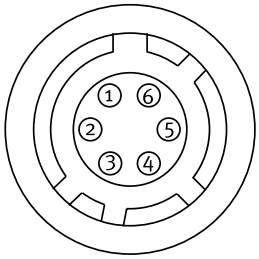
* Note : To change the signal output on pin no. 6, 7 and 9, it is necessary to make jumper setting.
See “7-2. Jumpers on board” for more informations.

| Pin no. | Factory pre-set | Others |
|---|---|---|
| 6 | HD input | HD output |
| 7 | VD input | VD output |
| 9 | NC | Pixel clock output |

**CAUTION**

1. When trigger signal is input at #5 of 6 pin multi connector, do not input/output HD signal at #6 of 12 pin multi connector, as it causes a failure in Ext. trigger mode.
2. Do not use video output at the same time both from #4 of 12 pin multi connector and BNC connector, as it causes a failure on video signal due to double termination.

## 5-2. 6 pin connector (TRIGGER connector)




HR10A-7R-6P (Hirose) male

| Pin no. | HD/VD input or output | Ext. trigger/readout |
|---|---|---|
| 1 | TXD output | |
| 2 | RXD input | |
| 3 | Ground | |
| 4 | Ground | |
| 5* | **See note 2. | Ext. trigger input |
| 6* | WEN output | |

* Note : 1. To change the signal output on pin no. 5 and 6, it is necessary to make jumper setting. See “7-2. Jumpers on board” for more informations.

| Pin no. | Factory pre-set | Others |
|---|---|---|
| 5 | Trigger input | NC |
| 6 | WEN output | NC |

2. Do not input HD or VD signal at pin no.5, when the camera is set at Continuous mode.

**CAUTION**

When trigger signal is input at #5 of 6 pin multi connector, do not input/output HD signal at #6 of 12 pin multi connector, as it causes a failure in external trigger mode.

# 6. Functions and operations

## 6-1. Input/output of HD/VD signal

a) Input of external HD/VD signal (Factory pre-set)

To input ext. HD/VD signal, make JP9/JP11 short-circuited, and JP12/JP13 open-circuited. To change the termination of ext. HD/VD signal, it is neccessary to make the jumper JP8/JP10 short-circuited. All jumpers are located on PK8273 board. For details, please refer to 7-2-3. Jumpers on PK8273 board.

Note : Factory pre-set is set at HD/VD input (TTL) .

b) Output of internal HD/VD signal

To output int. HD/VD signal, make jumper JP9/JP11 open-circuited, and JP12/JP13 short-circuited. All jumpers are located on PK8273 board. Please refer to 7-2-3. Jumpers on PK8273 board.

**CAUTION**

Int. HD/VD signal is effective only at 75 Ohm termination.

## 6-2. Ext. trigger/readout mode

Ext. trigger mode of CV-M40 allows 3 different driving modes, as follows.

| | | |
|---|---|---|
| Edge pre-select trigger mode | : | Asynchronous reset by the external trigger pulse<br>Exposure period controlled by 8-step fixed shutter steps |
| Pulse-width control mode | : | Asynchronous reset by the external trigger pulse<br>Exposure period controlled by the pulse width of the external trigger pulse. |
| Frame-delay readout mode | : | Asynchronous reset by the external trigger pulse<br>Exposure period controlled by 8 fixed shutter steps<br>Video readout timing controlled by rising edge of the external trigger pulse. |

### 6-2-1. Edge pre-select mode

In this mode, the exposure starts at the falling edge of the external trigger pulse. The WEN pulse originates from the camera.
The shutter speed is controlled by the SW1 switch on the rear panel of the camera and the RS 232C serial interface.
For details, refer to the timing charts section of this manual.

To use this mode, set up the camera as follows ;

a) Set SW1-5 at ON, and SW1-6 at OFF to select the Edge pre-select mode.

b) Set SW1-1 to SW1-3 to select the appropriate shutter speed. For controlling the shutter speed by the RS 232C serial interface, set SW1-8 at ON.

c) Set the SW1-4 switch to ON to select the Binning mode and set the switch SW1-7 to OFF to select the Partial scan mode.

**CAUTION**

The pulse width of the external trigger pulse must be 2H to 1300H.

### 6-2-2. Pulse width control mode

In this mode, the exposure time is controlled by the pulse width of external trigger pulse. The exposure starts at the falling edge of the external trigger pulse and ends at the rising edge of the external trigger pulse. The WEN pulse is generated and output from the camera.
For details, refer to the timing charts section of this manual.

To use this mode, set up the camera as follows ;

a) Set SW1-5 at OFF, and SW1-6 at ON to select the Pulse width control mode.

b) Set the SW1-4 switch to ON to select the Binning mode and set the switch SW1-7 to OFF to select the Partial scan mode.

**CAUTION**

The pulse width of the external trigger pulse must be 2H to 525H.

### 6-2-3. Frame-delay readout mode

In this mode, the timing of the video output is controlled by the width of the external trigger pulse. The exposure starts at the falling edge of the external trigger pulse and ends according to the shutter setting. The video signal is output at the rising edge of the external trigger signal. The WEN pulse is generated and output from the camera.
For details, refer to the timing charts section of this manual.

To use this mode, set up the camera as follows ;

a) Set SW1-5 at ON, and SW1-6 at ON to select the Frame-delay readout mode.

b) Set SW1-1 to SW1-3 to select the shutter speed.

c) Set the SW1-4 switch to ON to select the Binning mode and set the switch SW1-7 to OFF to select the Partial scan mode.

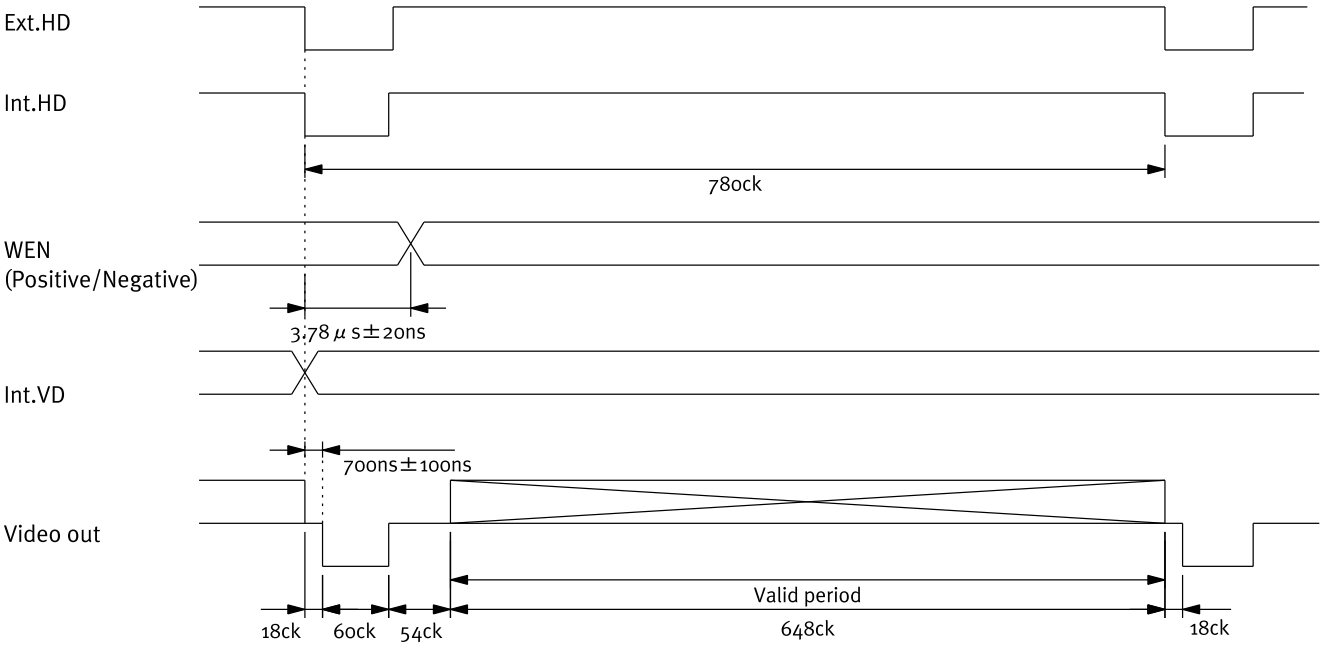
**CAUTION**

The minimum value of pulse width for the external trigger pulse depends on the exposure time, as follow.
Minimum : pulse width (more than 3H) > exposure time

## 6-2-4. Timing charts

### 1. Video out (H)

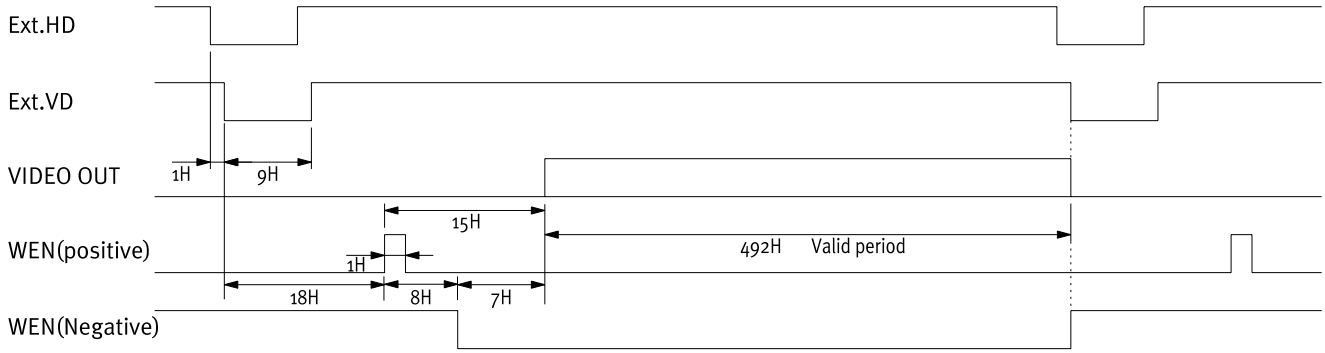
Note:1ck=40.7nsec



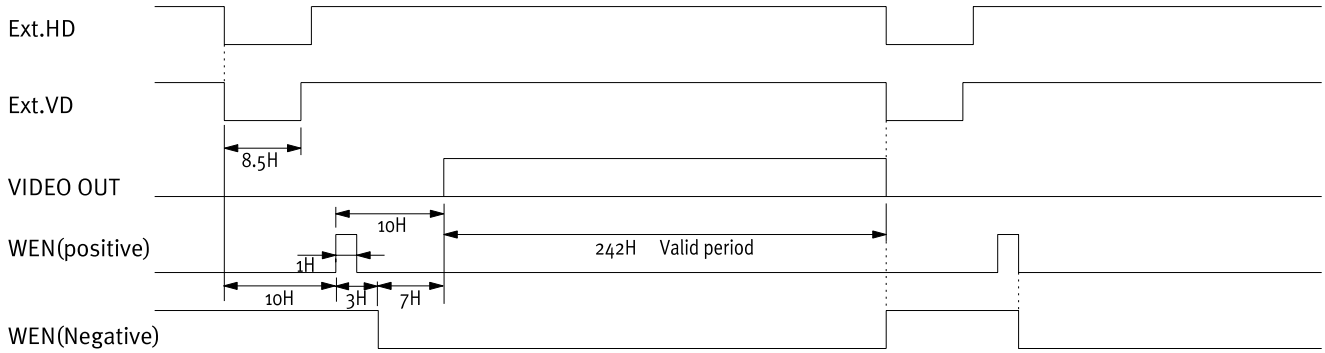

### 2. Ext. sync mode

Note 1:Sync or HD is not mentioned
Note 2:1H=31.777μS
Note 3:WEN polarity can be chosen at JP22 of I/F board

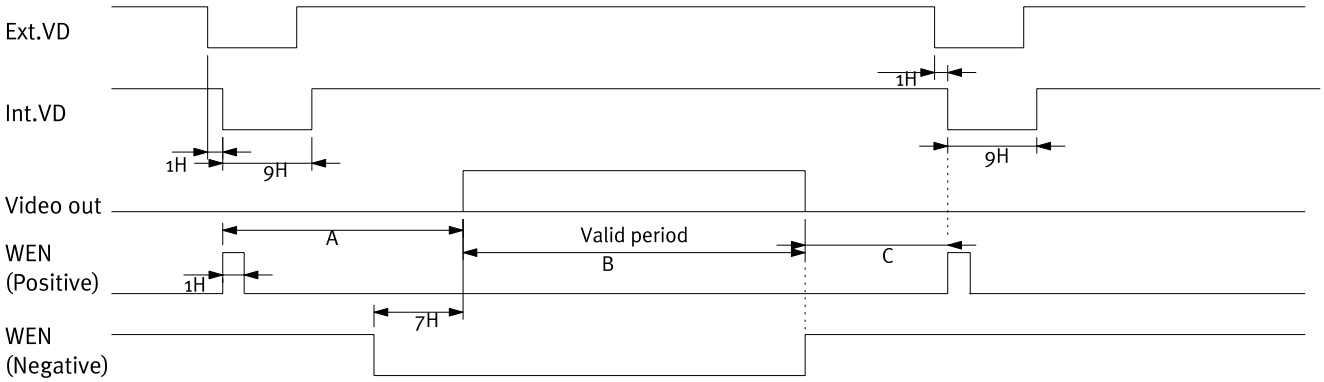
2-a) Normal readout(1/60sec.1frm=525H,60frm/sec.)




2-b) Binning readout(1/120sec.1frm=262H,120frm/sec.)



2-c) Partial Scan



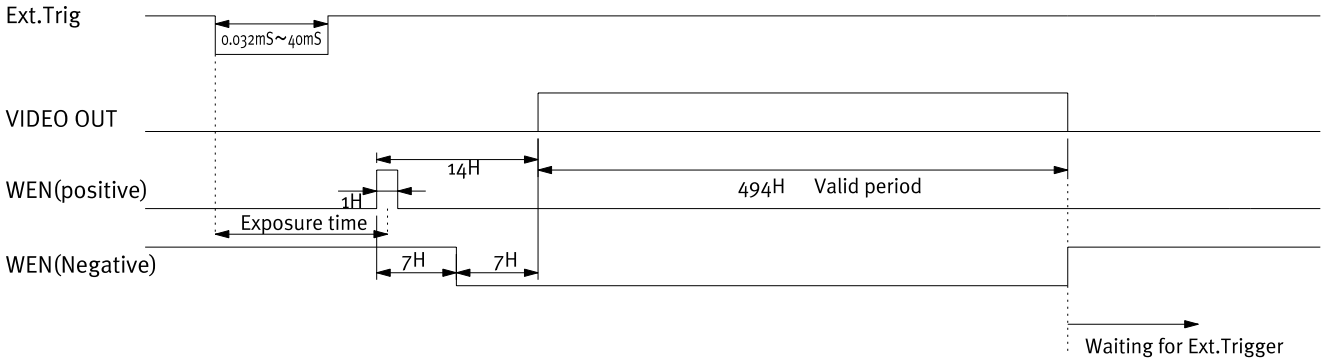

| Effective readout line | A | B | C |
|---|---|---|---|
| 240 line | 44H | 240H | 11H |
| 120 line | 65H | 120H | 15H |
| 60 line | 79H | 60H | 17H |
| 30 line | 86H | 30H | 18H |

Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 μ S
Note 3:WEN polarity can be chosen at JP22 of I/F board

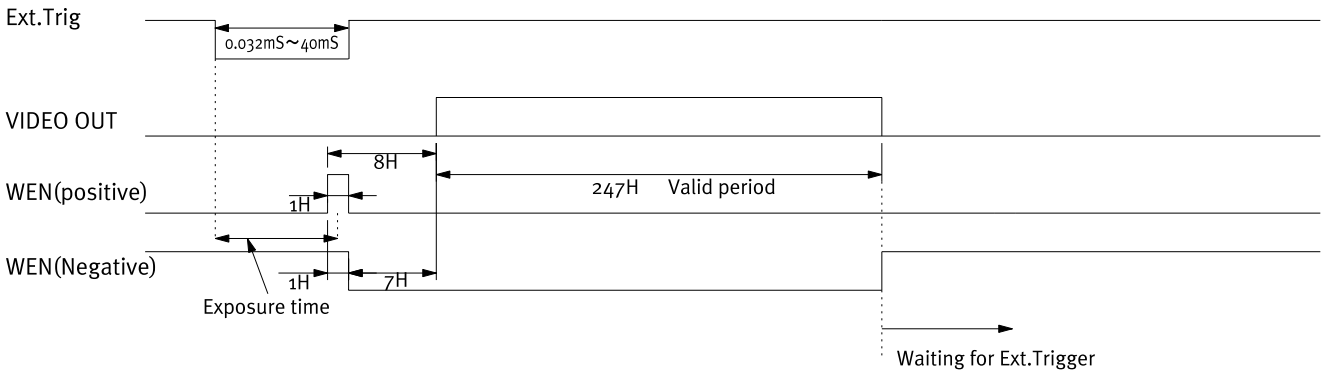
## 3. Edge pre-select mode

3-a) 60 fps = normal readout

Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 μ S
Note 3:WEN polarity can be chosen at JP22 of I/F board

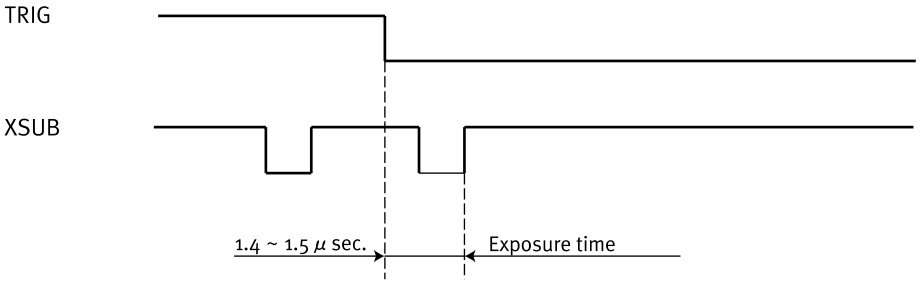



3-b) 120 fps = binning readout

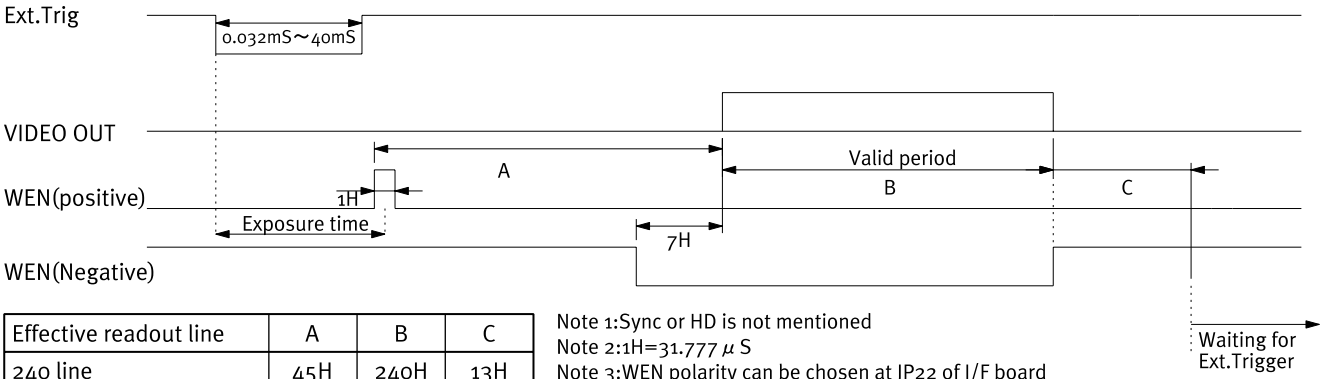


Enlarged

Note : The following charts discribes the delay of the exposure




3-c) partial scan



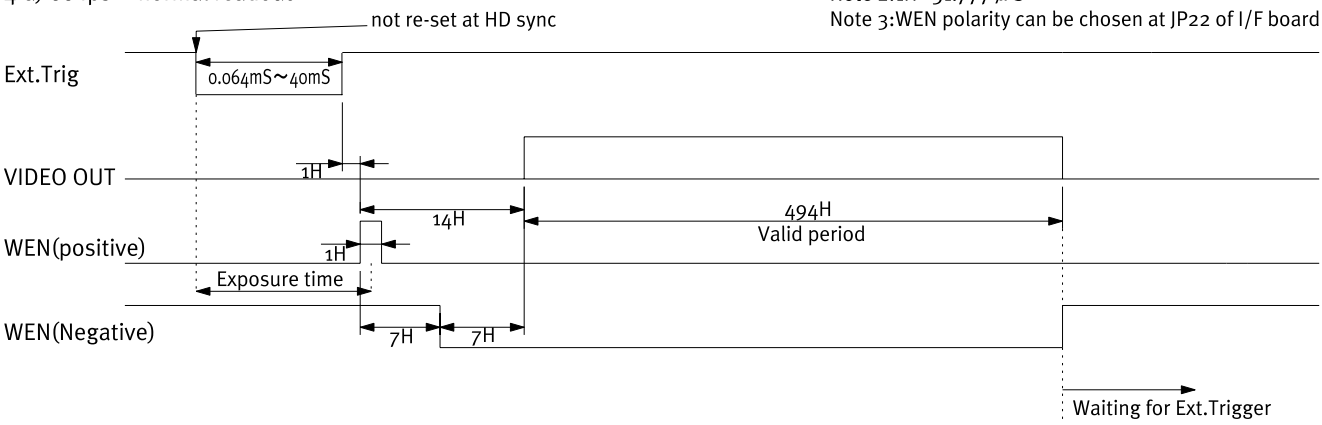

| Effective readout line | A | B | C |
|---|---|---|---|
| 240 line | 45H | 240H | 13H |
| 120 line | 66H | 120H | 17H |
| 60 line | 80H | 60H | 19H |
| 30 line | 87H | 30H | 20H |

Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 μ S
Note 3:WEN polarity can be chosen at JP22 of I/F board

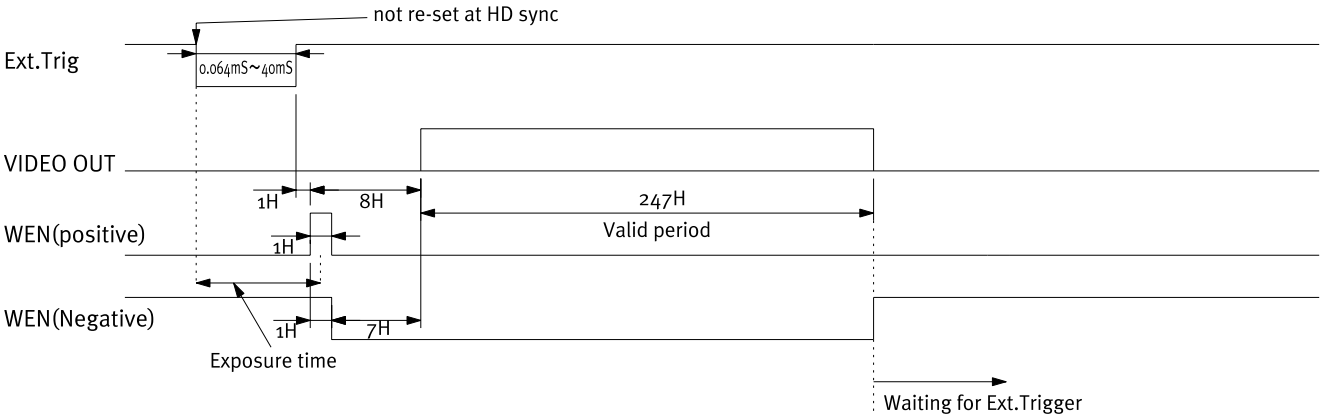
## 4. Pulse width control mode

4-a) 60 fps = normal readout

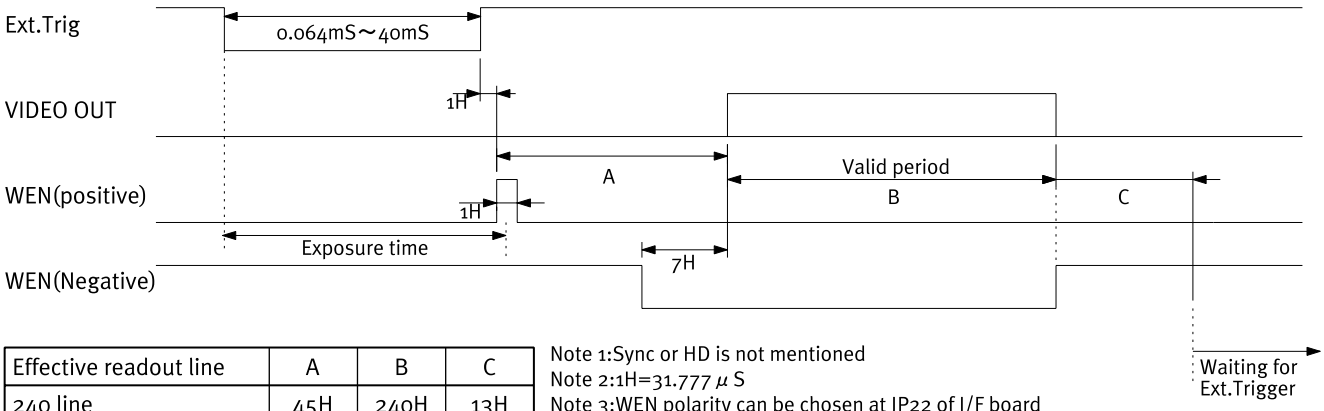
Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 μ S
Note 3:WEN polarity can be chosen at JP22 of I/F board




4-b) 120 fps = binning readout




4-c) Partial scan




| Effective readout line | A | B | C |
|---|---|---|---|
| 240 line | 45H | 240H | 13H |
| 120 line | 66H | 120H | 17H |
| 60 line | 80H | 60H | 19H |
| 30 line | 87H | 30H | 20H |

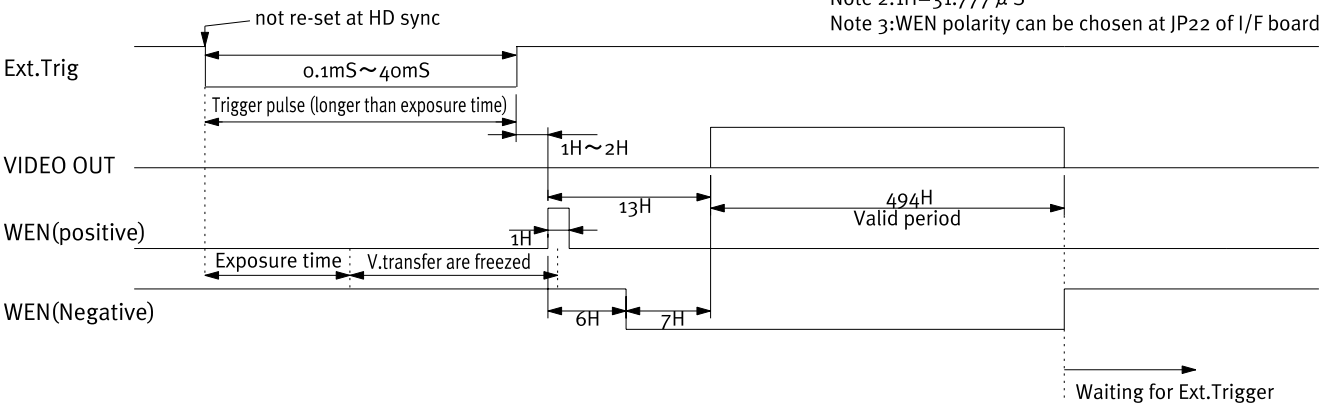
Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 μ S
Note 3:WEN polarity can be chosen at JP22 of I/F board

## 5. Frame-delay readout mode

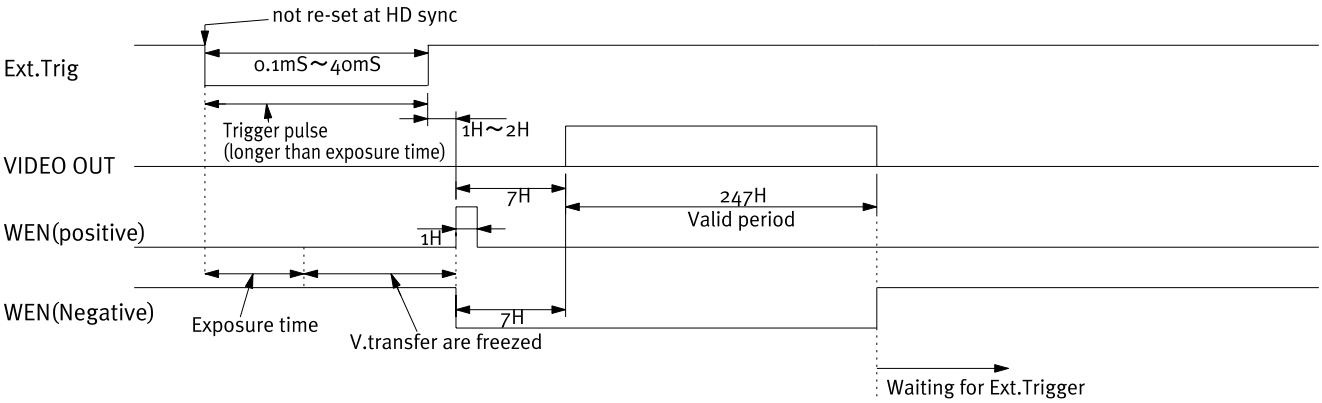
Unit : 1HD (31.777 µsec.)

5-a) 60 fps = normal readout

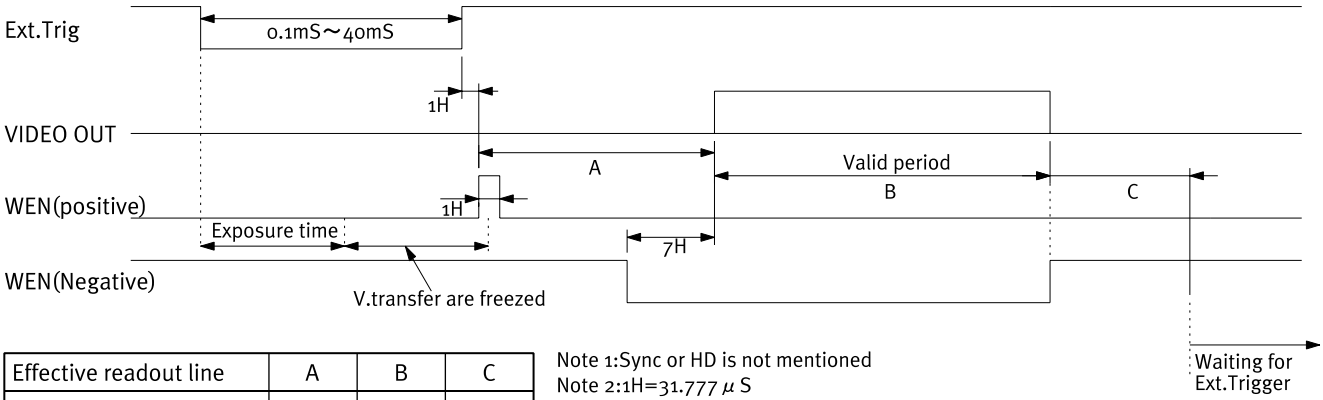
Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 µ S
Note 3:WEN polarity can be chosen at JP22 of I/F board




5-b) 120 fps = binning readout




5-c) Partial scan

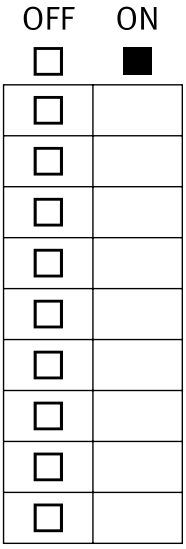



| Effective readout line | A | B | C |
|---|---|---|---|
| 240 line | 45H | 240H | 13H |
| 120 line | 66H | 120H | 17H |
| 60 line | 80H | 60H | 19H |
| 30 line | 87H | 30H | 20H |

Note 1:Sync or HD is not mentioned
Note 2:1H=31.777 µ S
Note 3:WEN polarity can be chosen at JP22 of I/F board

# 7. Mode setting

## 7-1. SW1 switch on the rear panel




| SW no. | Switch function | Setting mode | |
|---|---|---|---|
| | | OFF | ON |
| 1 | Shutter speed | Refer to "6-1-1.Shutter speed" | |
| 2 | | | |
| 3 | | | |
| 4 | Binning mode | OFF | ON |
| 5 | Ext. trigger/readout mode | Refer to "6-1-3. Ext. trigger/readout mode" | |
| 6 | | | |
| 7 | Partial scan mode | OFF | ON |
| 8 | RS 232C interface | OFF | ON |

Note : The above switches are set at OFF position by factory pre-set.

### 7-1-1. Shutter speed (SW1-1, SW1-2, SW1-3)

| Shutter speed | Switch setting (OFF : ☐/ON : ■) | | | | | |
|---|---|---|---|---|---|---|
| | SW1-1 | | SW1-2 | | SW1-3 | |
| 1/125 | ☐ | | ☐ | | ☐ | |
| 1/250 | ☐ | | ☐ | | | ■ |
| 1/500 | ☐ | | | ■ | ☐ | |
| 1/1,000 | ☐ | | | ■ | | ■ |
| 1/2,000 | | ■ | ☐ | | ☐ | |
| 1/4,000 | | ■ | ☐ | | | ■ |
| 1/8,000 | | ■ | | ■ | ☐ | |
| 1/12,000 | | ■ | | ■ | | ■ |

**CAUTION**

1) SW1-1, SW1-2 and SW1-3 switches are effective only when the SW1-8 switch is set at OFF position.

2) Exposing the CCD to direct or scattered bright light or to AC powered light, the following may appear.
- Strong smear and/or blooming.
- Noticeable flicker in the picture.

### 7-1-2. Binning mode (SW1-4)

This switch selects the Binning mode.

OFF : Normal mode (60 frames/sec.)
ON : Binning mode (120 frames/sec.)

**CAUTION**

At the Binning mode, please note that vertical resolution would be lower (1/2 approx.) of normal mode.

### 7-1-3. Ext. trigger/readout modes (SW1-5, SW1-6)

These switches select the ext. trigger/readout mode, as below.

| Ext. trigger mode | Switch setting (OFF : □/ON : ■) | | | |
|---|---|---|---|---|
| | SW1-5 | | SW1-6 | |
| OFF | □ | | □ | |
| Edge pre-select | | ■ | □ | |
| Pulse width control | □ | | | ■ |
| Frame-delay readout | | ■ | | ■ |

### 7-1-4. Partial scan (SW1-7)

This switch selects the Partial scan mode. The effective number of lines can be set via RS 232C, or by jumpers.

OFF : Normal readout mode
ON : Partial scan mode

### 7-1-5. RS 232C interface (SW1-7)

This switch selects the RS 232C interface.

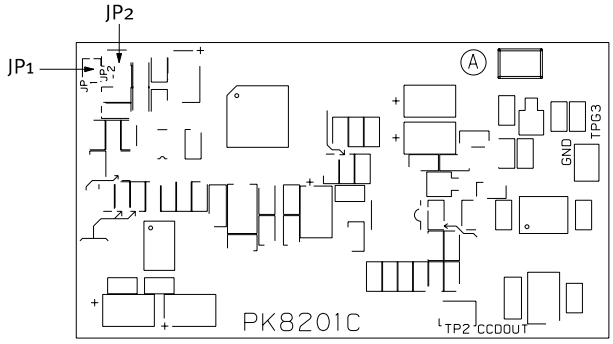
OFF : All functions can be set by switches and jumpers.
ON : RS 232C interface is activated.

## 7-2. Jumpers on board

### 7-2-1. Jumpers on PK8201 board

Jumpers JP1 and JP2 are used to select the gamma setting. See table below for options. Please note that both jumpers must be in the "open" position to allow RS 232C setting of gamma. If no setting is provided via RS 232C, the camera will default to gamma 1.0.

| Jumpers | Setting by jumpers | | Setting by RS 232C | Forbidden |
|---|---|---|---|---|
| | 0.45 | 1.0 | | |
| JP1 | Short | Open | Open | Short |
| JP2 | Open | Short | Open | Short |




Note : Gamma is set at "Setting by RS 232C interface" with 1.0.

**CAUTION**

Do not set the jumpers both JP1/JP2 at short circuited, as it causes a serious damge to the camera.

### 7-2-2. Jumpers on PK8202 board

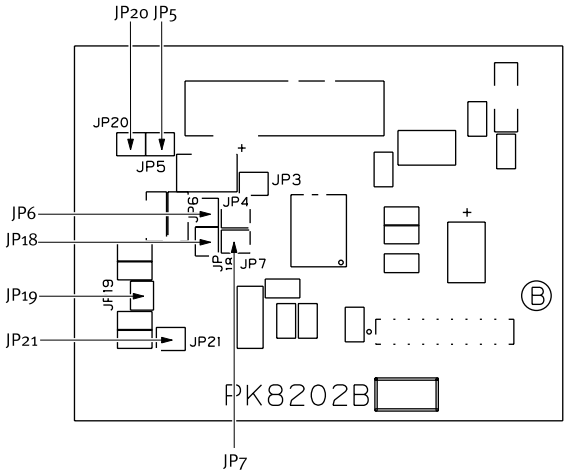
Jumpers JP5, JP6 and JP7 enable or disable the ext. trigger input, the WEN output and pixel clock output, respectively.

| Jumpers | #5 of 6pin connector | | #6 of 6pin connector | | #9 of 12 pin connector | |
|---|---|---|---|---|---|---|
| | NC | Trigger in | NC | WEN out | NC | Pixel clock out |
| JP5 | Open | Short | | | | |
| JP6 | | | Open | Short | | |
| JP7 | | | | | Open | Short |

| Function Mode | Rear Board (PK8202) | | | | | | |
|---|---|---|---|---|---|---|---|
| | JP5 | JP6 | JP7 | JP18 | JP19 | JP20 | JP21 |
| Int. Sync | O | O | O/S | O/S | O/S | O | O/S |
| Ext. Sync | O | O | O/S | O/S | S | O | S |
| H Rest Trigger (12P) | O | O | O/S | O/S | S | O | S |
| H Non Reset Trigger (12P) | O | O | O/S | O/S | S | O | S |
| H Rest Trigger (6P) | S | S | O/S | O/S | O | O | O |
| H Non Reset Trigger (6P) | O | S | O/S | O/S | O | S | S |

O=Open S=Short

H Reset Trigger Mode and H Non Reset Trigger Mode are corresponding to the following triggers: Edge Pre-select Mode, Pulse Width Control Mode, and Frame Delay Readout Mode
(12P):Trigger Mode using only 12 pin connector
(6P): Trigger Mode where 6 pin connector is used for both Trigger and WEN, and 12 pin connector is used for HD input.
JP7 and JP18 must not be SHORT at the same time.



### 7-2-3. Jumpers on PK8273 board

a) Jumpers JP8 thru JP13 control the input/output state as well as the termination of the HD and VD signals on pin #6 and #7 of the 12 pin connector.

| Function Mode | I/F Board (PK8273) | | | | | |
|---|---|---|---|---|---|---|
| | JP9 | JP12 | JP8 | JP11 | JP13 | JP10 |
| Int. Sync | O/S | O/S | O/S | O/S | O/S | O/S |
| Ext. Sync | S | O | O/S | S | O | O/S |
| H Reset Trigger (12P) | O | S | - | S | O | O/S |
| H Non Rest Trigger (12P) | S | O | O/S | S | O | O/S |
| H Reset trigger (6P) | O | S | - | S | O | O/S |
| H Non Reset trigger (6P) | S | O | O/S | S | O | O/S |

| Pin no. of 12pin connector | #6 | | | #7 | | | Factory pre-set |
|---|---|---|---|---|---|---|---|
| | HD signal | | | VD signal | | | #6:input #7:input |
| | Input | | Output | Input | | Output | |
| Jumpers | 75 ohm | TTL | 75 ohm | 75 ohm | TTL | 75 ohm | |
| JP8 | | | | Short | Open | | Open |
| JP9 | | | | Short | | Open | Short |
| JP10 | Short | Open | | | | | Open |
| JP11 | Short | | Open | | | | Short |
| JP12 | | | | Open | | Short | Open |
| JP13 | Open | | Short | | | | Open |

b) Jumpers JP14 thru JP17 control the effective number of lines in the partial scan mode.

| Valid period | JP14 | JP15 | JP16 | JP17 |
|---|---|---|---|---|
| 30Line 30(V) × 648(H) | Short | Open | Open | Open |
| 60Line 60(V) × 648(H) | Open | Short | Open | Open |
| 120Line 120(V) × 648(H) | Open | Open | Short | Open |
| 240Line 240(V) × 648(H) | Open | Open | Open | Short |

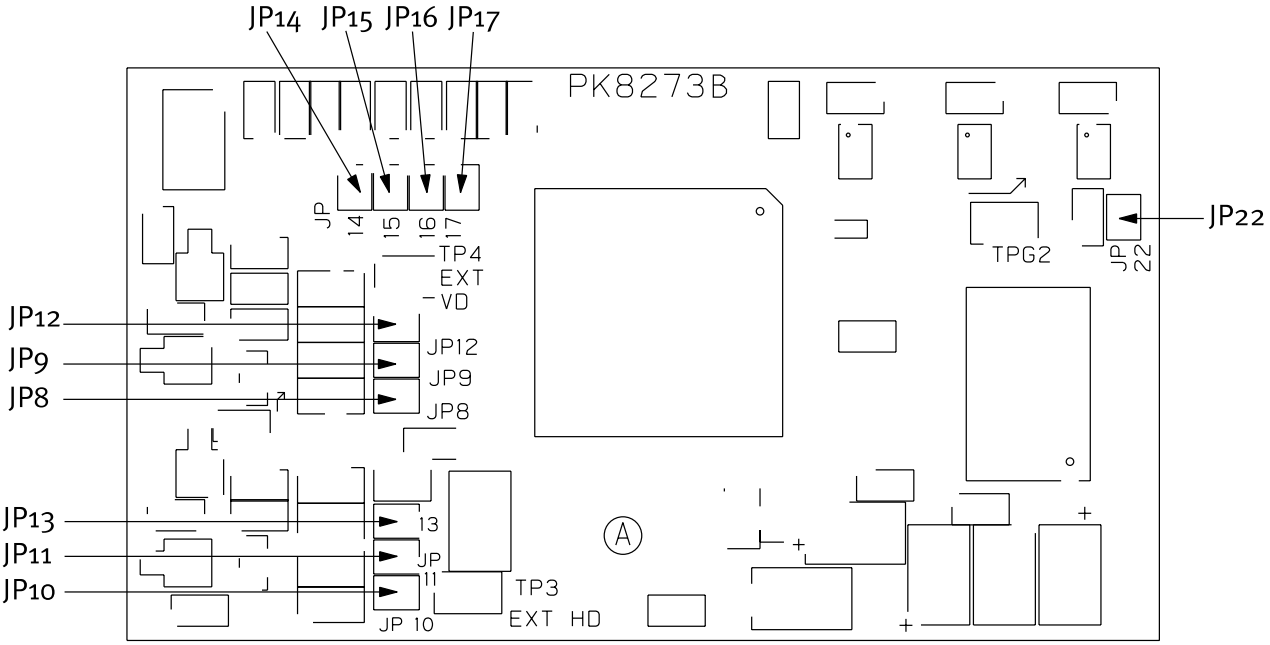
Note : Partial scan is set at 120 (v) as factory pre-set.

c) JP22 WEN Polarity Reversing

When JP22 is set to OPEN, WEN is output, and only 1H period becomes HIGH level before video output starts. The periods from WEN output and video start may differ at each mode.

When JP22 is set to SHORT, WEN's image output period becomes LOW level, and after finishing output, it becomes HIGH level.

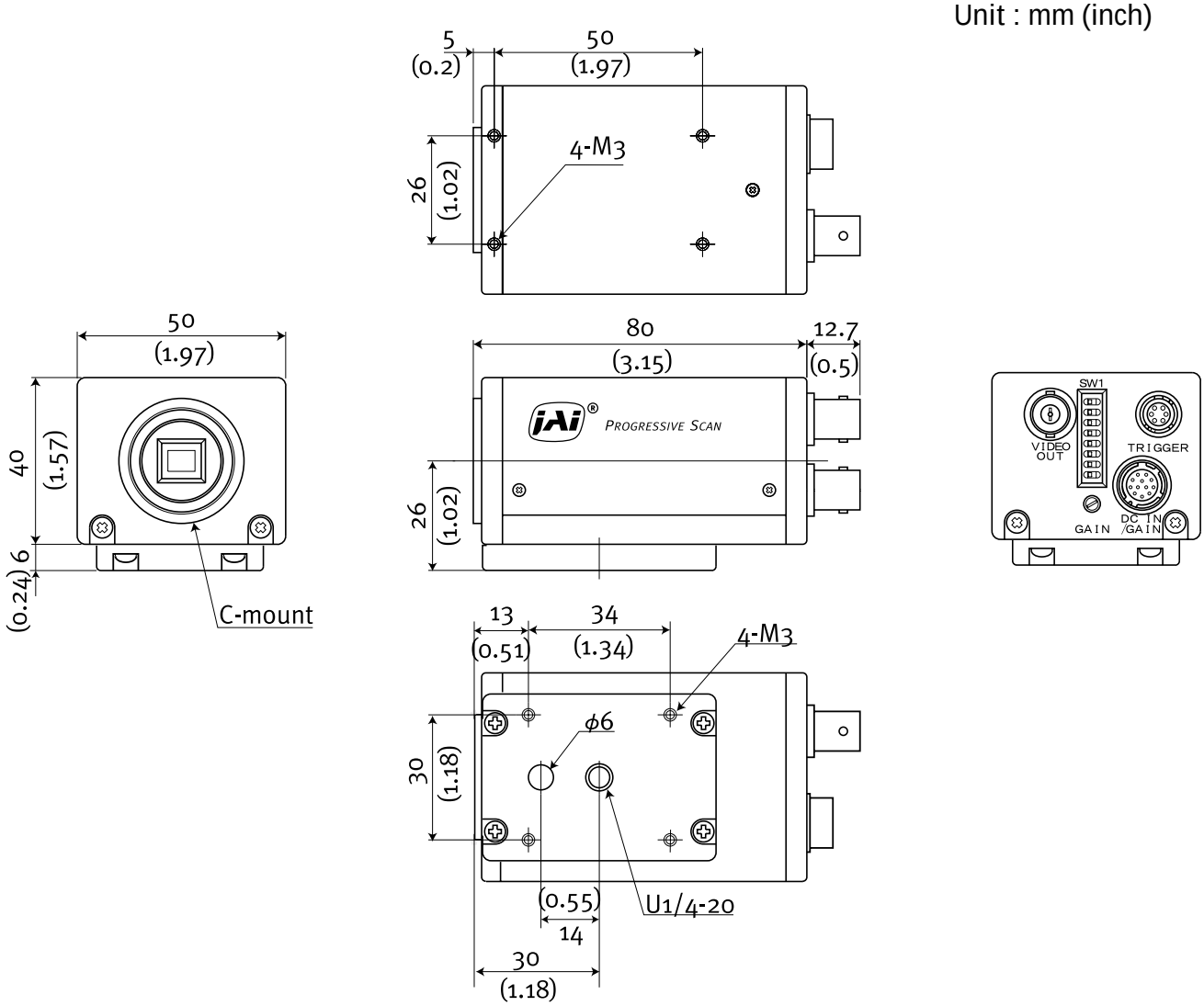
The periods from WEN output and video start is same at each mode.




Board No. PK8273B

# 8. External appearance

Unit : mm (inch)



# 9. Specification

| Model name | **CV-M40** |
|---|---|
| Scanning system | 525 lines, 60 frames/sec. |
| CCD sensor | Monochorme 1/2" IT CCD sensor progressive scan |
| Sensing area for video out | 6.4 mm (h) x 4.8 mm (v) |
| Effective pixels | 659 (h) x 494 (v) |
| Cell size | 9.9 (h) x 9.9 (v) µm |
| Resolution (horizontal) | 480 TV line |
| Resolution (vertical) | 480 TV line |
| Sensitivity | 0.23 Lux, Max gain, 50% video |
| S/N ratio | 48 dB (AGC OFF, Gamma=1.0) |
| Video output | Composite VS signal 1.0Vpp at 75Ohm<br>or<br>Video without sync. 0.7 Vpp, 75 Ohm |
| Gain | Auto or manual (0 to + 12 dB) |
| Gamma | 1.0 or 0.45 |
| Synchronization | Internal X'tal., ext. HD/VD or random trig |
| Shutter | off (1/60) 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000, 1/12000 |
| Serial interface | RS 232C |
| Functions | Electronic shutter, Ext. trigger mode, Binning mode, Partial scan |
| Operating environment | Temperature : -5 °C to +45 °C<br>Humidity : 20% to 80% non-condensing |
| Power | +12 VDC ± 10%, 5 w |
| Lens mount | C-mount |
| Dimensions | 40 x 50 x 80 (HxWxD) mm |
| Weight | 245 g approx. |

Note : Above specifications are subject to change without notice.

# 10. Appendix

## 10.1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera.

The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.

Do not attempt to disassemble this camera.

Do not expose this camera to rain or moisture.

Do not face this camera towards the sun, extreme bright light or light reflecting objects.
Even when this camera is not in use, put the supplied lens cap on the lens mount.

Handle this camera with the maximum care.
Operate this camera only from the type of power source indicated on the camera.

Power off the camera during any modification such as changes of jumper and switch setting.

## 10.2. Typical CCD Characteristics

The following effects may be observed on the video monitor screen. They do not indicate any fault of the CCD camera, but do associate with typical CCD characteristics.

### V. Smear

Due to an excessive bright object such as electric lighting, sun or strong reflection, vertical smear may be visible on the video monitor screen. This phenomenon is related to the characteristics of the Interline Transfer System employed in the CCD.

### V. Aliasing

When the CCD camera captures stripes, straight lines or similar sharp patterns, jagged image on the monitor may appear.

### Blemishes

Some pixel defects can occur, but this does not have en effect on the practical operation.

### Patterned Noise

When the CCD camera captures a dark object at high temperature or is used for long time integration, fixed pattern noise (shown as white dots) may appear on the video monitor screen.

## 11. User's Record

**Camera type:** **CV-M40**

**Scanning system:** **EIA**

**Revision:** **(Revision C)**

**Serial No.** **.....**

**Users Mode Settings**

**Users Modifications**

This manual can be downloaded from: www.jai.com

2700-11114 E C1 0701

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